

What is claimed is:

1. A molding die for a hollow ceramic monolithic support comprising:

a die that has an introduction hole section provided with introduction holes through which a material is introduced, and a slit section provided with slits that communicate with said introduction holes for molding the material into honeycomb shape;

an outer periphery guide ring having an outer periphery erected portion that extends from the outer peripheral end of said slit section in the extruding direction, and an outer periphery protruding portion that protrudes from said outer periphery erected portion inward and is separated from said slit section by a gap provided therebetween; and

an inner periphery guide ring having an inner periphery erected portion that extends from the central portion of said slit section in the extruding direction, and an inner periphery protruding portion that protrudes from said inner periphery erected portion outward and is separated from said slit section by a gap provided therebetween.

2. The molding die for a hollow ceramic monolithic support according to claim 1, wherein the gap between said inner periphery protruding portion and said slit section is in a range from 0.05 to 2 mm.

3. The molding die for a hollow ceramic monolithic support according to claim 1, wherein the ratio C1/C2 is in a range from 0.8 to 1.2 with C1 being the gap between said outer periphery protruding portion and said slit section and C2 being the gap between said inner periphery protruding portion and said slit section.

4. The molding die for a hollow ceramic monolithic support according to claim 1, wherein the slits located in a layer of a size one to 10 cells from the distal end of said inner periphery protruding portion outward have a width larger than that of the other slits in said die.

5. The molding die for a hollow ceramic monolithic support according to claim 1, wherein the slits located in a layer of one to 10 cells from the distal end of said outer periphery protruding portion inward have width  
5 larger than that of the other slits in said die.

6. A method of manufacturing a hollow ceramic monolithic support, which comprises manufacturing a hollow ceramic monolithic support that has a hollow space in an inner periphery skin portion thereof, by extrusion  
10 molding a ceramic material using a molding die comprising a die that has an introduction hole section provided with introduction holes through which the material is introduced and a slit section having slits that communicate with the introduction holes for forming the  
15 material into honeycomb shape, an outer periphery guide ring that has an outer periphery erected portion extending from the outer peripheral end of said slit section along the extruding direction and an outer periphery protruding portion protruding from said outer periphery erected portion inward while being separated  
20 from the slit by a gap provided therebetween, and an inner periphery guide ring that has an inner periphery erected portion extending from the center of said slit section along the extruding direction and an inner periphery protruding portion protruding from said inner periphery erected portion outward while being separated  
25 from said slit section by a gap provided therebetween;

wherein the outer periphery skin portion is formed from the ceramic material that passes through the gap between said outer periphery protruding portion and said slit section of said outer periphery guide ring, the inner periphery skin portion is formed from the ceramic material that passes through the gap between said inner periphery protruding portion and said slit section of said inner periphery guide ring, and the main body of  
30 35 the honeycomb structure surrounded by said inner periphery skin portion and said outer periphery skin

portion is formed from the ceramic material that is extruded through said slit section, thereby to make the hollow ceramic monolithic support that has the hollow portion in the inner periphery skin portion.

5       7. The method of manufacturing the hollow ceramic monolithic support according to claim 6, wherein the gap between said inner periphery protruding portion and said slit section is in a range from 0.05 to 2 mm.

10      8. The method of manufacturing the hollow ceramic monolithic support according to claim 6, wherein the ratio C1/C2 is in a range from 0.8 to 1.2 with C1 being the gap between said outer periphery protruding portion and said slit section and C2 being the gap between said inner periphery protruding portion and said slit section.

15      9. The method of manufacturing the hollow ceramic monolithic support according to claim 6, wherein said slits located in a layer of from one to 10 cells from the distal end of said inner periphery protruding portion outward have width larger than that of the other slits in said die.

20      10. The method of manufacturing the hollow ceramic monolithic support according to claim 6, wherein the slits located in a layer in a range from one to 10 cells from the distal end of said outer periphery protruding portion inward have width larger than that of the other slits in said die.

25      11. A hollow ceramic monolithic support comprising:  
                a main body that has a multitude of cells surrounded by ribs of honeycomb structure;  
30          a hollow space formed to penetrate said main body at the central portion thereof in the longitudinal direction;  
                an outer periphery skin portion that covers the outer peripheral surface of said main body;  
35          and  
                an inner periphery skin portion that covers the inner peripheral surface of said main body,

wherein said ribs located in a layer in a range from one to 10 cells from said inner periphery skin portion are made to form a high strength portion that has higher strength than the other portion of ribs located outside thereof.

12. The hollow ceramic monolithic support according to claim 11, wherein said ribs located in a layer in a range from one to 10 cells from said outer periphery skin portion are made to form a high strength portion that has higher strength than the other portion of ribs located inward.

13. The hollow ceramic monolithic support according to claim 11, wherein said ribs of the high strength portion are made thicker than the ribs in the other portion thereby increasing the strength.

14. The hollow ceramic monolithic support according to claim 11, wherein the ratio T1/T2 is in a range from 0.8 to 1.2 with T1 being the thickness of said outer periphery skin portion and T2 being the thickness of said inner periphery skin portion.

15. A catalytic converter system to be installed in the exhaust system of an internal combustion engine comprising:

a first catalytic converter constituted from the hollow ceramic monolithic support of claim 11 and a second catalytic converter constituted from a solid ceramic monolithic support that has a multitude of cells surrounded by ribs in honeycomb structure and an outer periphery skin portion that covers the outer peripheral surface thereof,

wherein said first catalytic converter is disposed upstream in the exhaust system, incorporates the hollow ceramic monolithic support that has a first catalyst supported thereon and has a bypass passageway disposed in the hollow space, a purifying path consisting of the multitude of cells disposed to surround the bypass passageway and passageway switching means that switches

the passageway for the exhaust gas between the bypass passageway and the purifying path, and

the second catalytic converter  
incorporates the solid ceramic monolithic support  
disposed downstream of said exhaust system and having a  
second catalyst supported thereon,

while said first catalyst begins to be activated at a lower temperature than the second catalyst does.

10        16. The catalytic converter system according to claim 15, wherein said passageway switching means is constituted so as to switch between said bypass passageway and said purifying path according to the load on said internal combustion engine.

15        17. The catalytic converter system according to claim 15, wherein said passageway switching means is constituted so as to switch between said bypass passageway and said purifying path according to the cooling medium temperature of said internal combustion engine.

20        18. The catalytic converter system according to claim 15, wherein said passageway switching means is constituted so as to switch between said bypass passageway and said purifying path according to a combination of the load on said internal combustion engine and the temperature of said cooling medium.

25        19. The catalytic converter system according to claim 15, wherein said first catalyst is a very low temperature activating catalyst of which activation initiating temperature is 300°C or lower.

30        20. The catalytic converter system according to claim 15, wherein said first catalyst is a very low temperature activating catalyst of which activation initiating temperature is 200°C or lower.